

## A revision of the southern South American stag beetles of the genus *Sclerostomus* Burmeister (Coleoptera: Scarabaeoidea: Lucanidae)

M.J. PAULSEN

University of Nebraska State Museum, W436 Nebraska Hall, University of Nebraska, Lincoln, NE 68588-0514, U.S.A. (mpaulsen@unlserve.unl.edu)

### Abstract

Four species of stag beetles in the genus *Sclerostomus* Burmeister from southern South America (composing the subgenera *Chileistomus* Weinreich and *Sclerostomulus* Weinreich) are redescribed: *S. cucullatus* (Blanchard), *S. nitidus* Benesh, *S. tuberculatus* (Solier), and *S. varasi* Nagel. A key to the southern South American genera of Lucanidae and species of *Sclerostomus* are provided to facilitate identification. The classification of the genus within the Lucanidae is discussed. Nomenclatural problems within *Sclerostomus* are resolved, and the generic concept is fixed through a lectotype designation for the type species, *S. costatus* [Westwood]. Lectotypes are also designated for *S. cucullatus* (Blanchard) and *S. tuberculatus* (Solier). A neotype is designated for *S. varasi*, a validly described but heretofore misidentified species.

### Resumen

Cuatro especies de los ciervos volantes del sur de Sudamérica en el género *Sclerostomus* (componiendo los subgéneros *Chileistomus* Weinreich y *Sclerostomulus* Weinreich Burmeister) son redescritas: *S. cucullatus* (Blanchard), *S. nitidus* Benesh, *S. tuberculatus* (Solier) y *S. varasi* Nagel. Se proporcionan claves para los géneros de Lucanidae del sur de Sudamérica y para el género *Sclerostomus* para facilitar su identificación. Se discute la posición del género dentro de Lucanidae. Se resuelven los problemas nomenclaturales en *Sclerostomus* y el concepto del género con la designación del lectotipo para la especie tipo, *S. costatus* [Westwood]. Se designan también lectotipos para *S. cucullatus* (Blanchard) y *S. tuberculatus* (Solier). Un neotipo se señala para *S. varasi*, una especie válida pero hasta ahora incorrectamente identificada.

**Key words:** Taxonomic revision, identification key, Lucanidae, *Sclerostomus*, Chile

## Introduction

In my revision of the Chilean Lucanidae I have examined a large amount of material in several genera, including specimens and types in the genus *Sclerostomus*. Study of this material has revealed that there is sufficient uncertainty about the identity of the southern South American species placed in *Sclerostomus* to warrant redescription.

The genus *Sclerostomus* Burmeister is distributed throughout South America with the majority of species occurring in Brazil. Currently, 15 species are recognized (Weinreich 1960; Bomans & Arnaud 1996, 2002; Grossi & Racca-Filho 2004). Three species are known from Chile. Another Chilean species has been overlooked and the name misapplied to a member of a different genus. This situation is remedied herein with a neotype designation for *Sclerostomus varasi* Nagel.

*Sclerostomus* species are relatively small for lucanids, with total lengths of approximately 10 mm, although some species reach 17 mm. Several species have elytral patterns composed of scales or setae. Furthermore, in males of most species the anterior margin of the pronotum is developed in the form of either tubercles or a horn-like projection.

The taxonomic use of the genus *Sclerostomus* has been inconsistent in the past, with many South American lucanid taxa being placed in the genus at various times (see discussion under taxonomic history). Given the inconstant arrangement of the genera *Sclerostomus* and others, it is clear that the classification of South American Lucanidae suffers from a lack of comparative research. Furthermore, considering the instability of generic concepts and lack of characters to support genera, the current classification probably does not accurately reflect relationships between taxa.

The basis for this taxonomic confusion is that genera of Lucanidae are often tenuously united or divided based on characters of questionable value, as is the case for *Sclerostomus*. As currently delineated, *Sclerostomus* comprises six subgenera of tentative association. Two subgenera, *Chileistomus* Weinreich (containing only *S. cucullatus* (Blanchard)), and *Sclerostomulus* Weinreich (*S. tuberculatus* (Solier) and *S. nitidus* Benesh), are restricted to the western side of the Andes south of Santiago, Chile. Species in these subgenera are predominantly distributed in central Chile, although at least one species extends into adjacent areas of Argentina. Southern South America (see Materials and Methods) harbors many endemic genera of Scarabaeoidea, and species in this region show stronger phylogenetic affinities with the fauna of New Zealand and Australia than with that of the remainder of South America (Crisci *et al.* 1991; Smith 2002). For this reason, and because the generic association of the Chilean and Brazilian *Sclerostomus* species is tenuous at best (see below), it is appropriate to examine the southern South American members of the genus independently.

The main goal of this paper is to alleviate confusion about the southern South American *Sclerostomus* species, a necessary step before decisions can be made concerning the circumscription and taxonomy of the entire genus. Each species is redescribed, and

keys are given for both the southern South American lucanid genera and the species of *Sclerostomus*.

### Taxonomic History of *Sclerostomus*

The classification of *Sclerostomus* within the Lucanidae has been inconsistent, and the relationships between *Sclerostomus* and other genera of South American lucanids are similarly unstable. Species now placed as members of the genera *Apterodorcus* Arrow, *Beneshius* Weinreich, *Pycnosiphorus* Solier, and *Scortizus* Westwood have, in the past, been placed within *Sclerostomus* or have been congeneric with *Sclerostomus* species. On the whole, *Sclerostomus* and these similar South American genera were treated as relatives of *Dorcus* MacLeay at the time of their description (Thomson 1862; Parry 1864, 1875; Van Roon 1910; Didier & Seguy 1953).

Burmeister (1847) placed *Sclerostomus* in his “Lamprimidae” based on the lacinia of the maxilla being sclerotized and hooked in females but simple in males. Based on my comparative analyses, this placement was in error because male *Sclerostomus* have a hooked lacinia and should have been placed in Burmeister’s “Figulinae” (lacinia hooked in both sexes). Perhaps realizing this, Benesh (1955) removed *Sclerostomus* and *Pycnosiphorus* (as the Sclerostomini) to the Figulinae. He retained *Scortizus* and *Apterodorcus* (males with simple lacinia) in the Lampriminae. This classification is questionable because insect mouthparts display a high potential for convergent evolution with respect to diet (e.g., Betz *et al.* 2003). To illustrate the ineffectiveness of using laciniae as the basis for higher-level classification of the Lucanidae, even some species that are unquestionably lucanine, e.g., *Dorcus parallelipipedus* (L.), would be placed in the Lampriminae and not the Lucaninae using Burmeister’s (1847) classification.

Until fairly recently the Lucanidae were classified into as many as ten ill-defined subfamilies (e.g., Didier & Seguy 1953). Holloway (1960, 1969) introduced the first subfamilial classification of the Lucanidae based on robust character states (e.g., presence of a permanently everted internal sac of the male genitalia, eyes that are partially or completely divided by an ocular canthus) and discounted the importance of vaguely delineated higher taxa such as the “Dorcinae” and “Figulinae”. Holloway’s (1960, 1969) characters place *Sclerostomus* and relatives firmly within the Lucaninae. The tribal classification of the Lucaninae has not received adequate study, and it is reasonable to retain use of the tribe Sclerostomini until relationships within the Lucaninae can be examined.

Although classifications based on male mouthparts placed the genera *Sclerostomus* and *Scortizus* in different subfamilies, at other times they have been treated as congeneric or interchangeable. Parry (1875) considered species now placed in *Sclerostomus* to be members of the genus *Scortizus* and used *Sclerostomus* for species that currently are placed in several other genera. Later, van Roon (1910) followed Parry’s classification in

his lucanid *Coleopterorum Catalogus*, but inexplicably continued the use of the name *Sclerognathus* rather than its correct replacement, *Sclerostomus* (see below). Arrow (1943) argued that van Roons (actually Parry's) decision to remove the type species of *Sclerostomus* to the genus *Scortizus* rendered *Sclerostomus* a junior synonym of *Scortizus*. Arrow thought this transfer was justified due to the predominantly glabrous, compact antennal club shared by *Scortizus* and *Sclerostomus*. As a result of van Roon's (1910) mistake, Arrow (1943) removed from *Sclerostomus* (*sensu* Parry) the species with a mostly tomentose antennal club, using the name *Pycnosiphorus* to accommodate them. Thus, Arrow's generic concepts distinguished two groups, the first group (*Scortizus*) with the antennal club mostly glabrous and only the distal portion of each club segment tomentose, and the second group (*Pycnosiphorus*) with almost the entire surface of the antennal club tomentose.

Benesh (1955, 1960) separated *Sclerostomus* and *Scortizus* again based on the form of the lacinia in males (hooked in *Sclerostomus*; simple in *Scortizus*), and continued the use of *Pycnosiphorus*. However, not all members of Benesh's *Sclerostomus* possessed hooked laciniae in the male. In his revision of South American stag beetles, Weinreich (1960) removed species with simple male laciniae to a new genus, *Beneshius*. However, when Weinreich created his new genus he simultaneously made it a junior synonym of *Metadorcinus* by recording the only species in that genus, *M. auritus* Kreische, as a synonym of *Beneshius cruentus* (Burmeister). Bomans (1990) examined the type of *M. auritus* and determined that *Metadorcinus* and *Beneshius* are distinct genera. Weinreich (1960) also divided the species remaining in *Sclerostomus* between six subgenera. His subgeneric concepts were based on elytral sculpturing, the presence or absence of setae on the ventral surface of the male mandibles, and body shape. The validity of his subgeneric concepts has not been addressed, but future phylogenetic analyses will address the monophyly and relationships of these subgenera.

### Stabilizing taxonomy and nomenclature of *Sclerostomus*

There is confusion regarding the origin of the name *Sclerostomus* and its type species. Burmeister (1847) proposed the name as a replacement for *Sclerognathus* [Westwood], 1845; which was a junior homonym of *Sclerognathus* Valenciennes, 1844 (Pisces: Cypriniformes). According to Arrow (1936), Westwood anonymously published *Sclerognathus* in a paper that is often attributed to Hope (see Benesh 1960; Huchet 2000). Although Westwood (1845) referred the name to a Burmeister manuscript ("Burmeister MS"), it is clear that Westwood examined additional specimens and that the description is not solely taken from Burmeister. In fact, Burmeister's (1847) description of the genus discusses different characters and has little in common with Westwood's description. Thus, the name *Sclerognathus* is credited to Westwood, 1845 using Article 50.1.1 of the International Code of Zoological Nomenclature, (International Committee on Zoological

Nomenclature 1999) (hereafter “ICZN”), and square brackets are used to denote anonymity of authorship (Recommendation 51D, ICZN).

Burmeister (1847) proposed *Sclerostomus* as the replacement name for *Sclerognathus*. In doing so, Burmeister selected the name *Sclerognathus* as the correct original spelling (as the first reviser, Article 24.2.4 ICZN), because Westwood (1845) employed two spelling variants, either *Sclerognathus* or *Sclerognatus* in the original publication.

Westwood (1845) included in the genus only *Sclerognathus costatus*, thus fixing the type species of *Sclerognathus* by monotypy. Because a replacement genus has the same type species as the previously established name (Article 67.8, ICZN), *Sclerognathus costatus* [Westwood] is also the type species of *Sclerostomus*. The type species of *Sclerostomus* was erroneously reported as *Lucanus cucullatus* Blanchard by Luederwaldt (1935) and *L. darwini* Hope by Didier & Seguy (1953).

As with the generic name, Westwood indicated that *S. costatus* was a Burmeister manuscript name. It is clear that Westwood’s description was based in part on specimens from two collections (Miers and Hope) that he had on hand, requiring that at least two specimens comprise the type series. In the collection of the Oxford University, exactly two specimens bear modern *Sclerognathus costatus* type labels, one of which is also labeled as being from the Miers Collection. It is likely that these two specimens comprise the material that Westwood examined. Weinreich (1960) listed in the Oxford collection a male “type” and female “allotype”, but the specimens (labeled as syntypes) are in fact a major and minor male.

Because Westwood (1845) also used the Burmeister manuscript description, specimens that Burmeister based his description on are also included in the type series (Art. 72.4.1.1, ICZN). Burmeister (1847) indicated only that he saw specimens of each sex, and that the specimens were in Halle. In the material of the Martin Luther Universität, Halle, Germany, are four specimens of *S. costatus*. Weinreich (1960) listed these four specimens as possible paratypes. Burmeister did not label the specimens, and the earliest label on each is the Weinreich determination label from 1959. One female specimen has a different pin, but a second hole on the elytron shows that the original pin has been replaced.

I have examined all six specimens that constitute the type series of *Sclerognathus costatus* [Westwood], 1845. The syntype series in Halle is mixed and is composed of two subspecies. Because it is possible that more than one taxon is present in the type series, and because the taxonomic usage of the genus *Sclerostomus* has been inconsistent, it is necessary to stabilize the name by linking it with a specific taxon and specimen. Designating a lectotype will fix the identity of *S. costatus* for future revisionary work. The specimen from the Miers collection (now at OXUM) most closely approximates the original Latin description published by Westwood (1845) and is herein designated the lectotype. The remaining five specimens constitute paralectotypes. Labels for the entire type series are described below (conventions for transcription of this data presented under “Materials and Methods”).

*Sclerostomus costatus* ([Westwood], 1845)

*Sclerognathus costatus* [Westwood], 1845: 27. Lectotype male at OXUM with label data: a) red-bordered label, "TYPE / HOPE / ... / Coll.Hope.Oxon." with handwritten "Cat. Lucan 1845. p. 27", b) handwritten "Miers Coll.", c) handwritten "costatus Burm / nec. granulatus / cuniculus Dej Cat", d) handwritten "Sclerostomus / granulatus / Burmeister", e) black bordered label, "TYPE / ... / HOPE DEPT. OXFORD", handwritten "COL:305 1/2 / Sclerognathus / costatus Hope / (Westw.)", f) red label, "SCLEROGNATHUS / COSTATUS / [Westwood], 1854 / LECTOTYPE / det MJ PAULSEN 2004". **LECTOTYPE HERE DESIGNATED.** One paralectotype male (OXUM) with label data: a) handwritten "288", b) as "a" of lectotype, c) black bordered label, "TYPE / ... / HOPE DEPT. OXFORD", with handwritten "COL:305 2/2 / Sclerognathus / costatus Hope / (Westw.)", d) handwritten "genus, nearly allied to Coryptius capensis / Dej. or Xiphodontus Antilope Westw." Two paralectotype males and 1 paralectotype female (MLUH) labeled: a) "Sclerostomus / costatus / Burmeister / Weinreich det. 1959", b) "MLU Halle / WB Zoologie / S.Nr.", with handwritten "813122". c) "H. Bomans det.", handwritten "1985 / Sclerostomus / costatus West. / PLESIOTYPE". One female specimen (MLUH) with labels "a" and "b" as paralectotypes above, and c) "H. Bomans det.", handwritten "1985 / Sclerostomus / costatus ssp. / genalis Lued.". All paralectotypes labeled with a yellow label, "SCLEROGNATHUS / COSTATUS / [Westwood], 1854 / PARALECTOTYPE / det MJ PAULSEN 2005". All specimens with determination label "SCLEROSTOMUS / COSTATUS / [Westwood], 1854 / det MJ PAULSEN 2005."

**Taxonomic confusion in the southern South American species of *Sclerostomus***

The taxonomy and identity of the southern South American members of *Sclerostomus* has been the subject of confusion because of misidentifications, taxonomic transfers, errors in the literature, and lack of a rigorous taxonomic foundation for the group. From the very first description, complications surrounded the species. The description of *Lucanus cucullatus* Blanchard was published in 1847, but the accompanying illustration was published five years earlier in 1842 (see Sherborn & Griffin 1934). Thus, the correct citation is *Lucanus cucullatus* Blanchard, 1842 (Article 12.2.7 ICZN). This species was one of six transferred to *Sclerostomus* by Burmeister (1847).

Thomson (1862) cited the name "*Prionophorus cornutus* Solier, 1851" in his catalog of Lucanidae. Parry (1864) reported that Solier's 1851 description of a female specimen of "*S. cornutus*" on page 46 made that name a synonym of *S. cucullatus*. There is, however, no mention of *S. cornutus* in Solier (1851) on page 46, only *S. cucullatus*. There is no evidence for another publication by Solier in 1851. Furthermore, it is extremely implausible that two publications in 1851 would share identical subject matter and pagination. Harold (1868) and Luederwaldt (1935) treated the name as unpublished and

unavailable, and there appears to be no reason to attribute this name to Solier. Additional evidence of Thomson's error is that Solier did not use the name *Prionophorus* as reported by Thomson, rather *Prionophora* is introduced by Solier (1851) for a genus of melolonthine scarab. Thomson was perhaps referring to an unpublished version of the Solier manuscript or suffered a *lapsus calami*, and Parry perpetuated Thomson's mistake.

Solier (1851) published the description of a second Chilean species, *Dorcus tuberculatus*, however this species was not transferred to *Sclerostomus* until over 100 years later by Benesh (1955). Benesh (1955) also described another species of *Sclerostomus* from Chile, *S. nitidus*.

The greatest confusion surrounds the identity of *S. varasi*. Nagel (1932) described *Sclerostomus varasi* based on a single female. The type of this species was lost with the bulk of the Coleoptera in the bombing of Hamburg during World War II (Weidner 1976). Since that time, Nagel's name has been misapplied to a member of *Pycnosiphorus* (e.g., Weinreich 1960; Benesh 1960), based on Weinreich's (1960) description and illustration of the supposed male of *S. varasi*. Weinreich's illustration actually depicts a misidentified *Pycnosiphorus philippi* (Westwood). Nagel's (1932) original description was detailed and clearly refers to a Chilean species of *Sclerostomus* of which I have seen 17 specimens. Because the type was destroyed, I designate a neotype to stabilize the nomenclature (see discussion of *S. varasi* below).

### ***Sclerostomus*, *Chileistomus*, and *Sclerostomulus***

*Sclerostomus* is distinguished by Weinreich (1960) as follows (translated from the original German): "The species of this genus possess diverse characters. Common to all is the small body size (length 10–20 mm; width 3–4 mm), and the formation of the antennal club from three articles put tightly together, these articles tomentose only on their apical surface. Also, in the state of the mouthparts, which are, in contrast to *Beneshius* and *Scortizus*, the same in males and females. Both sexes have sclerotized and hook-like curved laciniae. Female genitalia with styli, and dorsal plate extended into a hyaline bluntly triangular lappet that surpasses the coxites" (Weinreich 1960, p. 70).

This generic concept is less than satisfying, being based on an amalgamation of characters that, taken singly, are of questionable generic importance. In particular, the antennal tomentosity used to separate the genera *Sclerostomus* and *Pycnosiphorus* is a character gradient with a few species of *Pycnosiphorus* approaching the nearly glabrous condition of *Sclerostomus* antennal clubs. As discussed previously, the form of the lacinia is problematic for delimiting taxa, and the distinctness of *Beneshius* from *Sclerostomus* is based solely on this character. Additional research is needed to define generic limits within the Sclerostomini. As a first step, the existing subgeneric concepts for *Chileistomus* and *Sclerostomulus* are discussed below.

**Subgenus *Chileistomus* Weinreich, 1960**

*Chileistomus* Weinreich, 1960: 74. Type species: *Lucanus cucullatus* Blanchard, 1842. The original subgeneric description translated from German: “General coloration dull black. Dorsal surface densely and regularly punctate, without distinct striae or ridges. Pronotum and elytra with regularly arranged small spots of whitish-yellow scales. Prothorax with ovate median flattened area, which in males is extended into a hood-like horn that surpasses the middle of the head. Mandibles of the male without a row of setae on the underside” (Weinreich 1960, p. 74).

This subgeneric description is so narrowly defined that it could pertain only to *S. cucullatus*. To include *S. varasi*, which in my analyses is most closely related to *S. cucullatus*, the subgenus would require a total redescription based on a lack of characters relative to other subgenera. One shared character of *S. varasi* and *S. cucullatus* is the presence of elytral scales, but setae-like scales are present in some species of Weinreich’s Brazilian subgenus, *Altitaiayus*. Although it is likely that this subgenus will be removed from *Sclerostomus* upon further investigation, I am refraining from assigning *S. varasi* to any subgenus until research on the entire genus, including all current subgenera, can be completed.

**Subgenus *Sclerostomulus* Weinreich, 1960**

*Sclerostomulus* Weinreich, 1960: 88. Type species: *Dorcus tuberculatus* Solier, 1851, by monotypy. The original subgeneric description translated from German: “Small, narrow, black shining. Upper surface without scales or scale-setae. Mandibles of males and females of the same form. Pronotum with three shining tubercles medially near the anterior margin. Elytra with punctate rows with more or less raised costae between them” (Weinreich 1960, p. 88).

The trituberculate pronotum (Fig. 10) is diagnostic for this subgenus. Also, the extreme lack of sexual dimorphism (even in the mandibles) is unusual in the Lucanidae and unique within *Sclerostomus*. The two species placed in this subgenus, *S. tuberculatus* and *S. nitidus*, are clearly closely related and form a distinct group. Superficially they resemble members of both *Sclerostomus s.s.* and *Beneshius*.

**Materials and methods**

**Specimens and Taxonomic Material.** Specimens examined for this study were provided by 24 institutions and private collections. A total of 451 specimens, including the type series of each species when extant, formed the basis of this research. Acronyms for institutions are from Samuelson *et. al.* (2001), when available.

AMNH	American Museum of Natural History, New York, NY (Lee Herman)
BMNH	Natural History Museum, London, UK (Malcolm Kerley)
CASC	California Academy of Sciences, San Francisco, CA (Roberta Brett)
CMNC	Canadian Museum of Nature, Ottawa, Canada (François Génier)
CNCI	Canadian National Collection of Insects, Ottawa, Canada (A. Davies)
FMNH	Field Museum of Natural History, Chicago, IL (Al Newton)
IADIZA	Instituto Argentino de Investigaciones de Zonas Áridas, Mendoza, Argentina (Sergio Roig-Juñent)
JMEC	José Mondaca E. Collection, Santiago, Chile
JTNC	Jacobo T. Numhauser Collection, Concepción, Chile
KSEM	Kansas State Entomological Museum, Manhattan, KS (Greg Zolnerowich)
MDCS	Manuel Diéguez Collection, Santiago, Chile
MGAC	Manuel Gálvez A. Collection, Rancagua, Chile
MJPC	M.J. Paulsen Collection, Lincoln, NE
MLPA	Universidad Nacional de La Plata, Argentina (Analía Lanteri)
MLUH	Martin Luther Universität Halle-Wittenberg, Germany (Karla Schneider)
MNHN	Muséum National d'Histoire Naturelle, Paris, France (Thierry Deuve)
MNNC	Museo Nacional de Historia Natural, Santiago, Chile (Mario Elgueta)
OXUM	Oxford University Museum of Natural History, Oxford, UK (Darren J. Mann)
SART	Sergio A. Rothmann T. Collection, Santiago, Chile
SLTC	Stephane Le Tirant Collection, Montreal, Canada (Stephane Le Tirant, Rene Limoges)
STAM	John Stamatov Collection, Armonk, NY
UCCC	Museo de Zoología, Universidad de Concepción, Concepción, Chile (Jorge Artigas)
UNSM	University of Nebraska State Museum (Federico Ocampo and Brett Ratcliffe)
ZIZM	Zoologisches Institut und Zoologisches Museum der Universität, Hamburg, Germany (Hans Riefenstahl)

**Definition of Study Area.** Southern South America is here defined as the central and southern parts of Chile (south of Santiago) and Argentina (south of the Río Colorado). This corresponds to the biogeographic regions of Central Chile and the Subantarctic used by Morrone *et al.* (1997). Crisci *et al.* (1991) defined southern South America more broadly as South America south of 30° S latitude, but the current usage better excludes neotropical areas of Argentina.

The southern South American species of *Sclerostomus* are found from 34° to 41° S latitude in Chile in Región VI (Libertador G. B. O'Higgins), Región VII (Maule), Región VIII (Biobío), Región IX (La Araucanía), and Región X (Los Lagos). Although

predominantly Chilean, one species has been collected in adjacent areas in Neuquén province, Argentina.

**Data Transcription.** Labels described are typeset on white or natural paper unless otherwise noted. Data that is not typeset on each label is indicated as handwritten. Each label is denoted with a letter designation, and the beginning of each new line of text is designated with “/” (backslash symbol). Vague locality data are indicated within quotation marks.

**Morphological Characters.** The following conventions were used during the collection of morphological data. Specimens were viewed under a dissecting microscope at 6.3 to 40x under fiber optic illumination.

**Length** was measured from the apex of the mandibles to the apex of the elytra. **Width** was measured at the widest point of the body, either the pronotum (*S. cucullatus*) or the elytra (other species). **Color** was determined under fiber optic illumination and magnification. The appearance of **vestiture** was described as seen under light magnification, not structurally as in Holloway (1997), and is comprised of either **setae** (simple, hair-like) or **scales** (broad, flattened, or branched). Most punctures contain a central seta that is erect and shorter than the puncture diameter. Scales are longer than the diameter of the associated puncture, generally decumbent, and form elytral patterning visible with the naked eye. **Tomentose** refers to the presence of a field of dense, short setae obscuring the underlying surface, while **pubescent** indicates the presence of dense, hair-like setae. **Puncture size** was defined as either coarse, large, moderate, or fine. Under 40x magnification, coarse punctures appear as pits over 0.10 mm in diameter and with a visible floor, usually containing a single scale / seta. Large punctures (0.06–0.10 mm) and moderate punctures (0.03–0.06 mm) may contain a scale or seta visible at 40x. Fine punctures are small (less than 0.03 mm) and lack structure or vestiture at a magnification of 40x. **Puncture density** was defined as contiguous, dense (punctures separated by less than 2 puncture diameters to almost contiguous), moderate (punctures separated by 2–4 puncture diameters), sparse (separated by more than 4 puncture diameters), and impunctate.

**Species Concept.** A modified phylogenetic species concept is applied in this study. Species are defined as the smallest aggregation of populations diagnosable by a unique combination of characters states (Wheeler & Platnick 2000). The application of a species concept is modified by the taxon to which it is applied. As applied to the Lucanidae, the form of the male genitalia, especially of the everted internal sac and median lobe, provide unambiguous characters for species hypotheses. Other traits, such as color and elytral pattern, are highly variable within and between populations and are discounted as informative species-level characters.

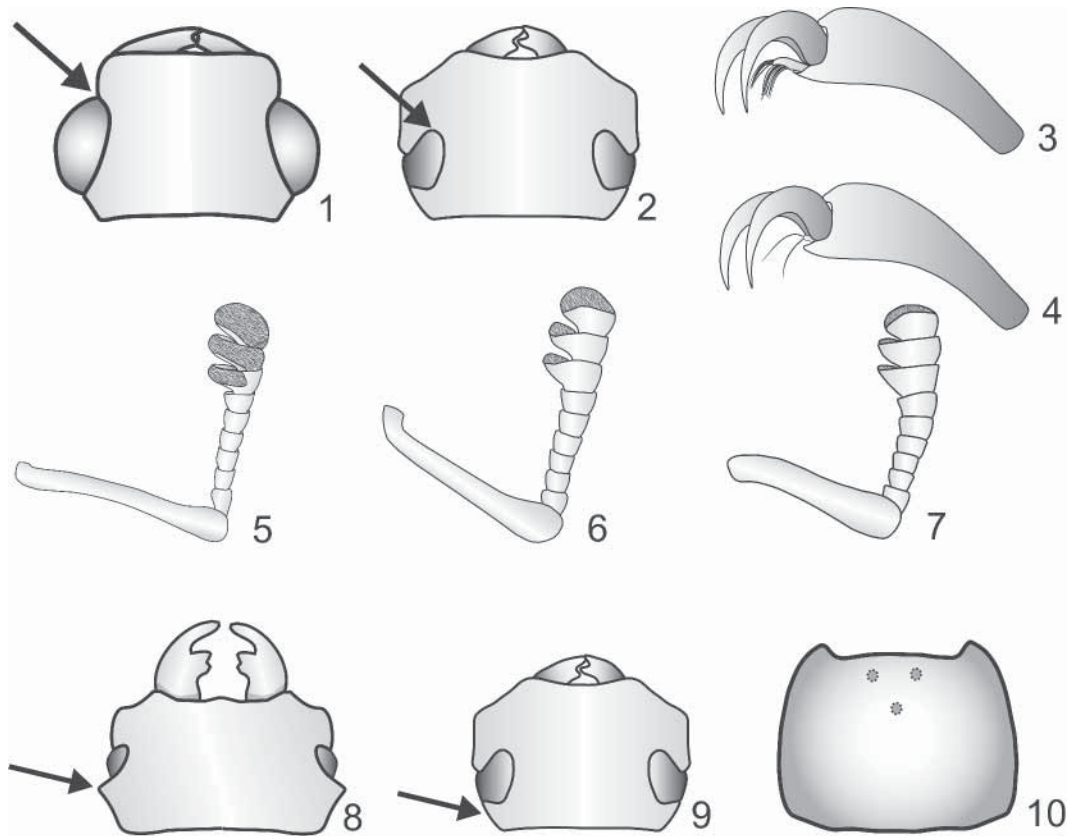
**Key to the genera of southern South American Lucanidae**

- 1 In dorsal view, eye not interrupted by ocular canthus, so front margin of eye located on side of head (Fig. 1). (Eye entire, without canthus *sensu* Holloway 1969) ..... 2
- In dorsal view, eye clearly interrupted anteriorly by ocular canthus, so front margin of eye located on upper surface of head (Fig. 2). (Eyes with canthus *sensu* Holloway 1969). (Lucaninae) ..... 3
- 2 In lateral view, eye nearly circular, anterior margin evenly rounded. Antennal club 3-segmented, club segments longer than scape. Elytra with scales. (Aesalinae) ..... *Ceratognathus* Westwood
- In lateral view, anterior margin of eye emarginate. Antennal club with 4 segments, club segments shorter than scape. Elytra glabrous, shining. (Lampriminae) ..... *Streptocerus* Fairmaire
- 3 Eye completely divided into upper and lower portions by an ocular canthus. Antennal club with 6 segments ..... *Chiasognathus* Stephens
- Eye not completely divided by an ocular canthus. Antennal club with 3 segments .... 4
- 4 Arolium with more than 2 setae (Fig. 3) ..... *Apterodorcus* Arrow
- Arolium with 2 setae (Fig. 4) ..... 5
- 5 Antennal club mostly tomentose, tomentosity of middle segment complete from apex to external edge (Fig. 5) ..... *Pycnosiphorus* Solier (in part)
- Antennal club mostly glabrous, tomentosity of middle segment confined to apex, not reaching external edge (Figs. 6, 7) ..... 6
- 6 In males, head behind eye produced laterally into an obtuse or subacute temoral process (Fig. 8); females with vertex of head behind clypeus tuberculate or elevated anteromedially ..... *Pycnosiphorus* Solier (in part)
- In males, head behind eyes not produced into a temporal process (Fig. 9); females with vertex of head behind clypeus not tuberculate or elevated anteromedially ..... *Sclerostomus* Burmeister

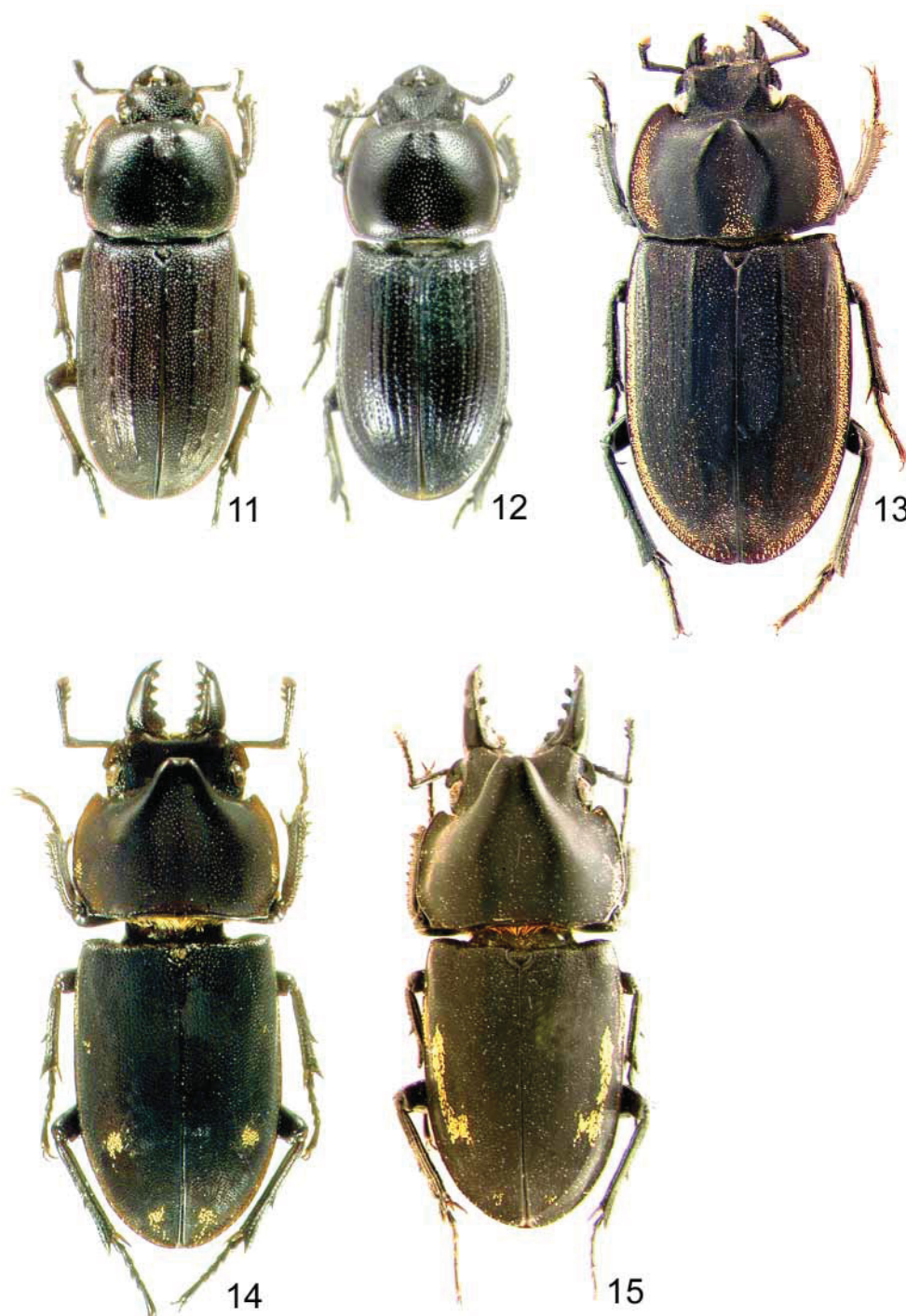
**Key to the Southern South American species of *Sclerostomus* Burmeister**

- 1 Pronotum with 3 weak tubercles surrounding an anteromedial depression (Fig. 10)... 2
- Pronotum lacking tubercles; in males, anteriorly elevated to strongly produced ..... 3
- 2 Elytra parallel-sided (Fig. 11); intervals variably raised with longitudinal carinae and tubercles ..... *S. tuberculatus* (Solier)
- Elytra not parallel-sided, instead widest in apical third (Fig. 12); disc punctate striate, lacking tuberculate carinae ..... *S. nitidus* Benesh
- 3 Elytral punctation not uniform in size, varying from fine on disc to coarse laterally. Pronotum and elytra with complete marginal bands of yellowish scales (Fig. 13); disc of elytra lacking scales ..... *S. varasi* Nagel
- Elytral punctation moderate, uniform in size and density. Weak marginal patch of

scales below humerus only; disc of elytra usually with roughly circular patches of scales (Fig. 14) or rarely longitudinal scale patches (Fig. 15) *S. cucullatus* (Blanchard)



**FIGURE 1.** Dorsal view of head of *Ceratognathus* spp. Arrow indicates the anterior margin of eye located on the side of the head. **FIGURE 2.** Dorsal view of head of *Sclerostomus* spp. Arrow indicates the anterior margin of eye located on the dorsal surface of the head. **FIGURE 3.** Last tarsal segment, claw, and arolium of *Apterodorcus bacchus* Hope. Arolium brush-like with multiple setae. **FIGURE 4.** Last tarsal segment, claw, and arolium of *Sclerostomus* spp. and *Pycnosiphorus* spp. Arolium with only two setae. **FIGURE 5.** Ventral view left antennae of most *Pycnosiphorus* species. Median club segment tomentose throughout its length. **FIGURE 6.** Ventral view left antennae of *S. cucullatus*. Median club segment tomentose only internally. **FIGURE 7.** Ventral view left antennae of *S. tuberculatus*. Median club segment tomentose only internally. **FIGURE 8.** Dorsal view of head of some *Pycnosiphorus* spp. males. Arrow indicates the temporal process. **FIGURE 9.** Dorsal view of head of *Sclerostomus* spp. Arrow indicates the simple postocular margin of the head, lacking a temporal process. **FIGURE 10.** Pronotum of *S. tuberculatus* and *S. nitidus* showing location of three anterior tubercles.



**FIGURE 11.** Dorsal habitus of *S. tuberculatus*. **FIGURE 12.** Dorsal habitus of *S. nitidus*. **FIGURE 13.** Dorsal habitus of *S. varasi*. **FIGURE 14.** Dorsal habitus of *S. cucullatus* male with most common elytral scale pattern. **FIGURE 15.** Dorsal habitus of *S. cucullatus* male with expanded elytral scale pattern.

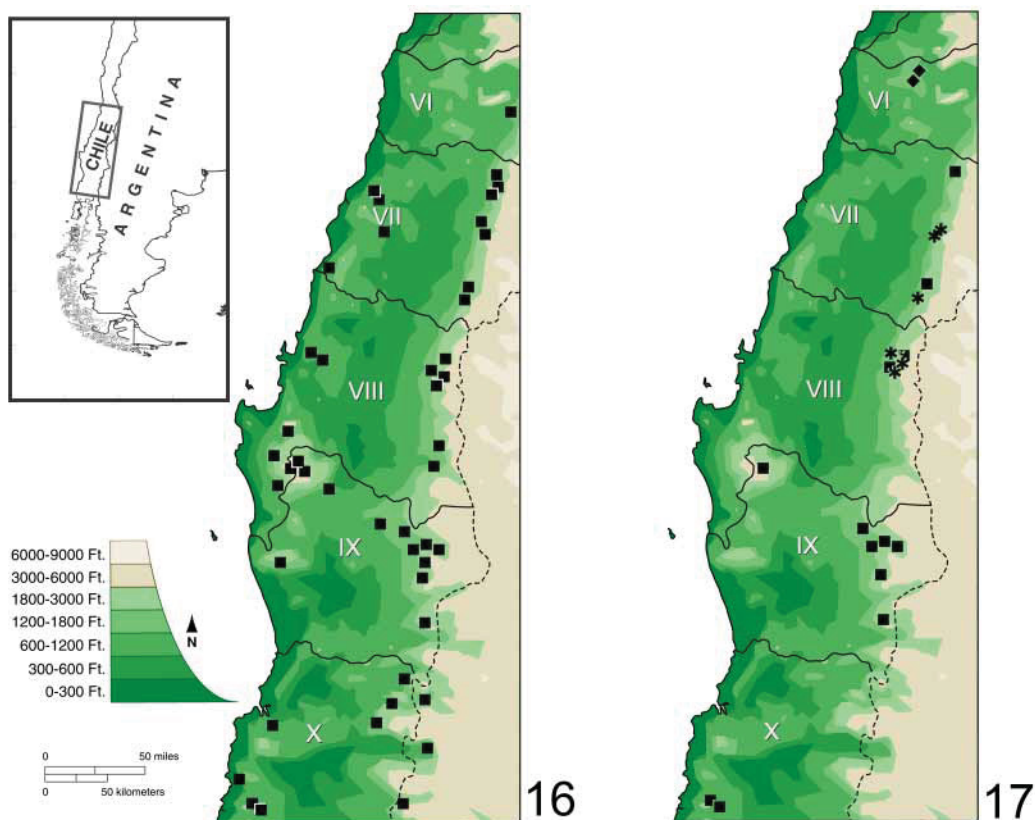
**Genus *SCLEROSTOMUS* Burmeister, 1847**

*Sclerostomus* Burmeister, 1847: 423. Replacement name for *Sclerognathus* [Westwood], 1845.

Type species *Sclerognathus costatus* [Westwood], 1845. The type species of a replacement genus is the same as that of the previously established genus (Article 67.8, ICZN).  
 synonym *Sclerognathus* [Westwood], 1845: 27. Junior homonym of *Sclerognathus* Valenciennes, 1844 (Pisces). Type species *Sclerognathus costatus* [Westwood], 1845, fixed by monotypy.

***Sclerostomus cucullatus* (Blanchard, 1842) (Figs. 14–16, 18)**

*Lucanus cucullatus* Blanchard, 1842: plate XII, Fig. 10. Lectotype at MNHN. Lectotype labeled: a) handwritten on underside of green circular label “3199 / 40”; b) handwritten “149”; c) “*Lucanus / cucullatus* / Blanchard, 1842 / LECTOTYPE/ det. M.J. Paulsen 2005” on red paper; d) “*Sclerostomus cucullatus* / (Blanchard, 1842) / det. M.J. Paulsen 2005”. **LECTOTYPE HERE DESIGNATED.**



**FIGURE 16.** Distribution of *S. cucullatus* (squares). **FIGURE 17.** Distribution of *S. varasi* (asterisks), *S. tuberculatus* (squares), and *S. nitidus* (diamonds).

**Description** (male, n=215). **Length:** 11.0–18.4 mm. **Width:** 4.1–6.9 mm. **Color:** Black, reddish-black, or blue-black. Weak iridescence present (clean specimens). **Head:** Shape enlarged, almost as wide as both elytra together. Vertex broadly, semicircularly excavated, excavation scarcely punctate posteriorly to moderately punctate anteriorly, punctures moderate to fine; lateral margin of excavation subcarinate above antennal insertions. Head with anterior margin (clypeus) strongly declivous before labrum. Labrum setose, projected ventrally, concealed when mandibles closed. Gena narrow, longer than eye, sides converging anteriorly, not continuous with anterior angle of head, punctate; punctures dense, moderate. Temporal processes lacking (Fig. 9). Mandible as long or longer than length of head, upwardly curved, broadest at base, narrowing to acute apex, punctate; punctures fine, dense; mandibular dentition serrate internally with 3–5 conical, rounded teeth and bicuspid basal tooth. Lacinia sclerotized, hook-like. Antennal club segments more than half glabrous with few scattered setae, tomentose area confined to distal surface of lamellae (Fig. 6). **Pronotum:** Broadest in basal third, broadly rounded anterolaterally. Disc anteromedially variably developed from slightly raised, bifurcate prominence (male minors) to large, conical, weakly bifurcate protuberance flattened dorsally in the same plane as disc and projecting above head (male majors); disc with weak median depression; median depression and lateral margins punctate; punctures moderate to coarse, disc elsewhere punctate; punctures moderately dense, moderate to fine, finer in male majors. Anterior angles produced, subacute. Lateral margin with shining bead. Posterior angles thickened, subdentate. Basal margin with bead, bead thickened near scutellum. Vestiture consisting of broken patches of yellowish-white scales along lateral margin; patches variably restricted to anterior angle, basal 1/3, and basal angle, scale patches subject to abrasion; scales golden yellow to almost white. **Scutellum:** Shape nearly semicircular, punctate medially; punctures moderate, setose; setae 4–5x longer than diameter of puncture, golden, subject to abrasion. **Elytra:** Disc punctate; punctures everywhere dense, nearly uniform in size, varying only from moderate to large. Vestiture consisting of each elytron with 5 scale patches: 1 subcircular patch near suture at about middle, 3 subcircular patches distributed on lateral declivity from humerus to apex, (Fig. 14), and 1 short longitudinal band of scales along lateral margin from below humerus to basal third; scale patches variably enlarged, occasionally with 2 posterior discal patches contiguous and forming a single longitudinal band (Fig. 15), patches occasionally reduced or abraded; scales golden yellow to yellowish-white. **Wings:** Fully developed. **Legs:** Meso- and metatibiae each with 1 large external tooth below middle; 0–2 smaller teeth proximally. Apex of metatibia acute. **Genitalia:** Parameres, median lobe, internal sac as in Fig. 18; Apices of internal struts prominent and visible below median lobe. Everted internal sac straplike, terminating in a bulbous appendage bearing a short hooked flagellum.

**Description** (female, n=161). As males, except in the following. **Length:** 3.8–6.2 mm. **Width:** 10.0–15.0 mm. **Head:** Size smaller than in male, width slightly larger than width of 1 elytron. Vertex parabolically excavated, margin of excavation impunctate basally, finely punctate above antennal insertions. Disc elsewhere (including median depression) punctate; punctures coarse, dense. Clypeus not strongly declivous before labrum. Labrum prominent, semicircular, projected anteriorly, visible when mandibles closed. Mandible shorter than length of head, not upwardly curved, apex acute, internally with tooth; internal tooth usually bifid, sometimes simple, especially on right mandible; left mandible received into dorsal notch on right mandible. **Pronotum:** Surface weakly raised anteriorly, lacking protuberance or horn.

**Diagnosis.** Larger males (male majors) of *S. cucullatus* are immediately recognizable due to the pronotal horn projecting above the head. Pronotal horn and mandible development are allometric, and smaller males approach females in pronotal form. Females and male minors can be readily separated from other *Sclerostomus* species by the elytral scale patches (if present) and the uniformly punctate elytra. Small specimens with abraded scales could be confused with *S. tuberculatus*, but the trituberculate pronotum of *S. tuberculatus* will separate the two species.

**Distribution** (Fig. 16). Chile and Argentina.

**Locality Data.** 372 specimens examined from AMNH, BMNH, CASC, CMNC, CNCI, FMNH, IADIZA, JMEC, JTNC, KSEM, MDCS, MGAC, MJPC, MNHN, MNNC, SART, SLTC, STAM, UCCC.

**ARGENTINA** (2). Neuquén (2): Paso Puyehue, San Martín de los Andes.

**CHILE** (370). VI Región (11): Alto Huemul, Los Cipreses. VII Región (76): R.N. Altos de Lircay, Alto Las Cruces, El Coigo/El Coigual, Estero Leiva, Cubillo, “Curico”, Estero La Jaula, Fundo Malcho, La Vinilla, 28 km de Linares, R.N. Los Ruiles, R.N. Los Queules, Palos Negros, Tregualemu, Vilches Alto. VIII Región (93): Atacalco, W. of P.N. Nahuelbuta, Caramávida, Cordillera Chillan, “Concepcion”, Contulmo, El Abanico, Florida, Fundo Castillo, Fundo El Roble, Invernada, Las Cabras, Las Trancas, Penco, Pillim Pilli, Recinto, 22.7 km ESE Recinto, 50 km E of San Carlos; IX Región (151): “Cautín”, Chacamo, Cherquenco, Cordillera Nahuelbuta W of Angol, P.N. Nahuelbuta, Collipulli, Cunco, Curacautín, 2 km E Lago Malleco, 10 mi NE Pucon, Relún, “Temuco”, 20 km E of Temuco, P. N. Tolhuaca, 4 km W Victoria, Flor de Lago Villarrica, 30 km NE Villarrica. X Región (14): Panguipulli, Pucatrihue Costa del Osorno, 30 km W Purranque, Riñihue, Santo Domingo, P. N. Villarrica. “Chile/Chili” (26).

**Temporal Data.** January (181), February (13), March (1), April (3), May (1), July (1), August (2), September (3), October (20), November (28), December (86).

**Remarks.** Blanchard published the illustration of this species in 1842. Two specimens from the MNHN in Paris bear “SYNTYPE” labels that were later added to the specimens. There are no locality data associated with the specimens, and the original description indicated only “Chili”. One specimen is a male (accession number 3199) that

entered the MNHN collection in 1840. The second specimen, a female (accession number 4) entered the collection in 1849, after the publication of both the original illustration and the species description. Another female specimen from the MNHN is labeled as entering the collection in 1843. Blanchard did not refer to the number of specimens examined, but both the description and illustration pertain only to a male specimen. The later date on the female specimens further opposes their selection as syntypes, and I am not considering the female specimens to be part of the type series. Because the number of original specimens is unclear, the male specimen in the MNHN is designated the lectotype.

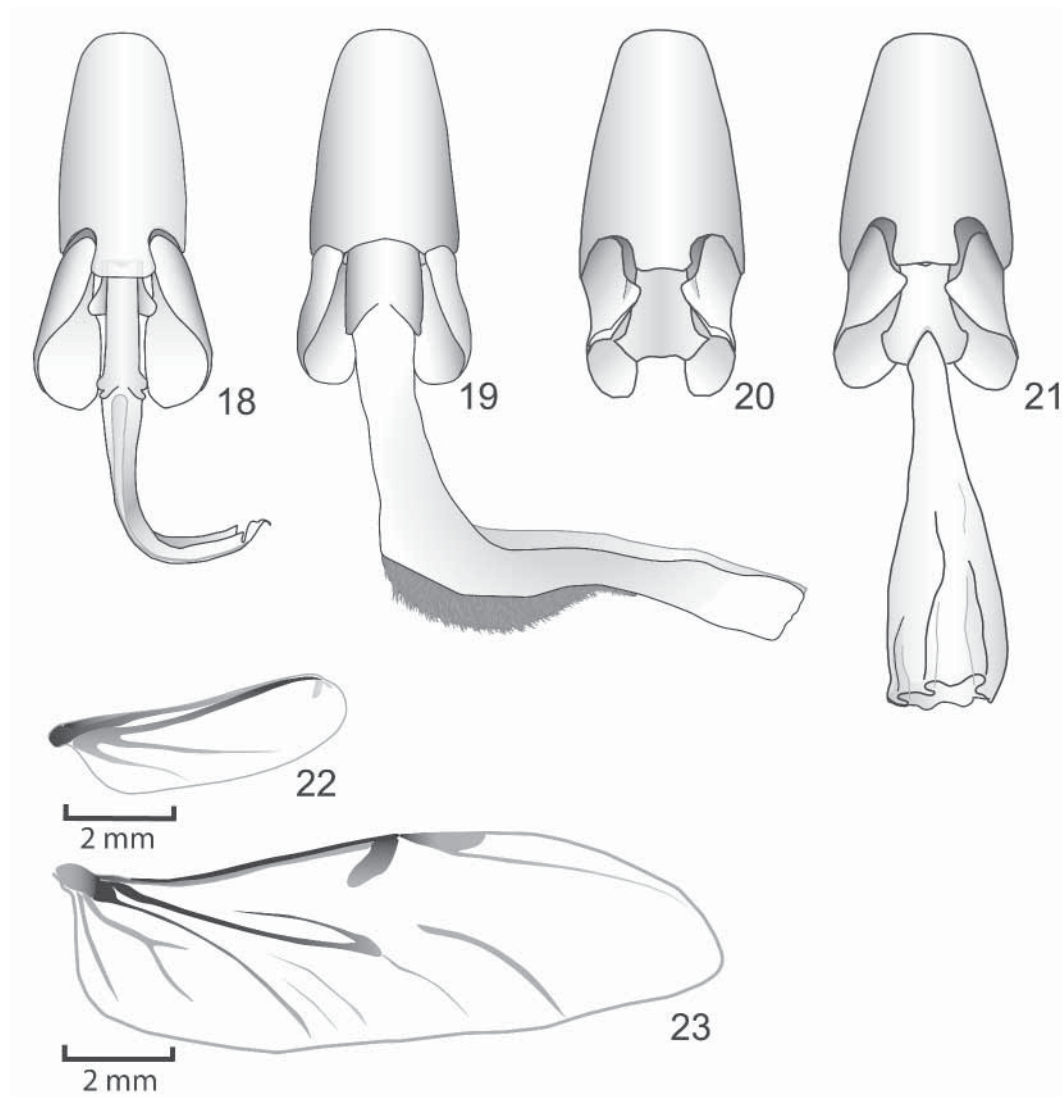
Although apparently common and frequently collected, biological information about this species is scarce. Label data on specimens indicate only that the adults are sometimes found on tree trunks at night. I have also collected *S. cucullatus* in this manner as the beetles actively climb *Nothofagus* trees just after dark. I encountered as many as six individuals on a single trunk. It is likely that adults congregate on certain trees, such as those with sap flows, to feed and mate. I also found adults walking after dark on fallen trunks. In some localities, adults were common under and within fallen branches. Finally, adults are often located by pulling back the loose bark of dead *Nothofagus* trees and stumps.

There is interesting variation in elytral pattern within *S. cucullatus*. Individuals from some Chilean coastal mountain ranges exhibit expanded scale patterns. Specimens from Reserva Nacional Los Queules (VII Región) and the surrounding area have the first two scale patches of the lateral elytral declivity united into a single longitudinal patch of golden scales (Fig. 15). A single specimen available from “Chacamo, W. of Temuco” (IX Región) has a similarly colored but even more expanded pattern, with additional longitudinal bands on the disc and an extended marginal band. Specimens from Alto Las Cruces, west of Talca (VII Región), have much larger scale patches than other populations, and the scale color is nearly white. However, specimens from other coastal mountain populations, notably in Cordillera de Nahuelbuta and Cerro Cayumanqui, have the same elytral pattern that is typical throughout most of the distribution. Biogeographically, the distribution of these elytral patterns argues that the coastal mountains in Chile have had a varied history, with the fauna of the Cordillera Nahuelbuta most similar to that of the Andes. There are no genitalic differences, even in the internal sac, between individuals with different elytral patterns. Moreover, not all specimens from coastal localities display a significantly expanded pattern. It is clear that the various patterns represent only minor variations within a single widely distributed species.

***Sclerostomus nitidus* Benesh, 1955** (Figs. 12, 17, 20, 22)

*Sclerostomus nitidus* Benesh, 1955: 99. Holotype female at MNNC labeled: a) “*Dorcus niti-/dus* Ph.1399” (handwritten Germain label); b) orange handwritten label “Holotype/

B. Benesh", on reverse "Sclerostomus / nitidus"; c) black "nitidus / Ph.", with red "1773", Germain handwritten; d) "nitidus / Philippi / m.m." and "Kuschel det. 195\_"; e) bordered white label "Sclerostomus / nitidus / Benesh / BB55" on reverse "Nomen MS / Det. B. Benesh / 21-XII-55"; f) "CHILE M.N.H.N. | Tipo N° 2212".



**FIGURE 18.** Male genitalia of *S. cucullatus*. **FIGURE 19.** Male genitalia of *S. varasi*. **FIGURE 20.** Male genitalia of *S. nitidus*, everted internal sac not shown. **FIGURE 21.** Male genitalia of *S. nitidus*, everted internal sac shown. **FIGURE 22.** Ventral view of right wing of *S. nitidus*. Bar indicates 2 mm. **FIGURE 23.** Ventral view of right wing of *S. tuberculatus*. Bar indicates 2 mm.

**Description.** Male (n=1), Female (n=3). Male previously undescribed, but sexual dimorphism minimal (see "Remarks" for *S. tuberculatus*). **Length:** 11.9–13.0 mm. **Width:**

4.5–5.1 mm. **Color:** Dark reddish brown to black. **Head:** As in *S. tuberculatus*. **Pronotum:** As in *S. tuberculatus* except shape more convex, longitudinal depression of the midline posterior to the fovea obsolete. Anterior angle more strongly produced than in *S. tuberculatus*, subangulate. **Elytra:** Sides not parallel, lateral margins rounded, constricted anteriorly to meet converging posterior pronotal angles, without scales. Disc with 6 striae; striae shallowly impressed, each a single row of punctures; punctures coarse, nearly contiguous, without scales. Intervals shining, without tubercles, weakly convex, punctate; punctures fine, irregular. Apex irregularly punctate; punctures coarse, dense. **Legs:** As in *S. tuberculatus*, external teeth somewhat stronger. **Wings:** (Fig. 22) Vestigial in both sexes. **Male Genitalia:** Parameres, median lobe, as in Fig. 20; everted internal sac apparently simple, similar to that of *S. tuberculatus* (Fig. 21).

**Diagnosis.** This species is closely allied to *S. tuberculatus* based on the presence of three pronotal tubercles, a trait shared only by these two species among the South American lucanids. It differs noticeably from it, however, in the simply punctate elytra and in the form of the median lobe of the male genitalia. Moreover, the wings of *S. nitidus* are atrophied (fully developed in *S. tuberculatus*).

**Distribution** (Fig. 17). Central Chile.

**Locality data.** 4 specimens known from MNNC, FMNH.

**CHILE** (4): VI Región (4): Cerro Poqui, “Coltauco”.

**Temporal data.** March (1), December (2), NO DATA (1).

**Remarks.** This species probably has the most restricted habitat of any Chilean lucanid, being known only from a single mountain (Cerro Poqui) near Coltauco. At an altitude of more than 1800 m, Cerro Poqui is one of the highest mountains in the coastal range of Chile. The forest, which is composed of roble (*Nothofagus macrocarpa* (A. DC.) Vazq. and Rodr.), is relictual and limited to the highest peaks (J. Mondaca; Santiago, Chile; personal communication). The lower slopes of this and nearby mountains are sparsely vegetated with sclerophyllous scrub. If the *Nothofagus* forest was more altitudinally widespread in the past, it is possible that this species could occur on neighboring peaks. Clearly, the ability of the brachypterous *S. nitidus* to now disperse across the xeric valleys between mountain-top forests is probably nil.

Given the intense pressures on native forests in Chile (Wilcox 1996), the viability of *S. nitidus* is in doubt. The species is assumed to be extant, although all known specimens were collected in the 1950s. I have little information on the status of the forest atop Cerro Poqui, other than it is difficult to reach and therefore may still be relatively untouched.

The biology of the brachypterous *S. nitidus* must differ greatly from that of the alate *S. tuberculatus*, which is a denizen of the canopy. It is possible that additional specimens of *S. nitidus* could be encountered under the bark of dead trees or under fallen branches as are other flightless lucanid species in Chile.

*Sclerostomus tuberculatus* (Solier) (Figs. 11, 17, 21, 22)

*Dorcus tuberculatus* Solier, 1851: 54. Lectotype male and damaged paralectotype (probably male) at MNHN. Lectotype labeled: a) handwritten on underside of green circular label "15 / 43"; b) "*Dorcus / tuberculatus* / Solier, 1851 / LECTOTYPE/ det. M.J. Paulsen 2005", on red paper; c) "*Sclerostomus tuberculatus* / (Solier, 1851) / det. M.J. Paulsen 2005". **LECTOTYPE HERE DESIGNATED.** Paralectotype labeled: a) handwritten on underside of green circular label "15 / 43"; b) "*Dorcus / tuberculatus* / Sol. Chili"; c) "*Dorcus / tuberculatus* / Solier, 1851 / PARALECTOTYPE/ det. M.J. Paulsen 2005", on red paper; d) "*Sclerostomus tuberculatus* / (Solier, 1851) / det. M.J. Paulsen 2005". Two specimens from the MHNH bear identical accession labels. Both entered the collection in 1843 and comprise the type series. I selected the most complete specimen as the lectotype; the other specimen is missing the abdomen and left elytron. Despite the missing structures, the acute apex of the hind tibia indicates that the damaged specimen is probably male.

**Description** (male, n=33; female, n=27). Sexual dimorphism lacking (see "Remarks"). **Length:** 9.9–13.7 mm. **Width:** 3.2–5.2 mm. **Color:** Dark reddish-brown to black. Iridescence lacking. **Head:** Width subequal to width of one elytron. Vertex weakly excavated medially from base to anterolateral angles, punctate; punctures fine, scarce on elevation, elsewhere moderate and dense becoming coarse basally. Margin of excavation above antennal insertion elevated, subtuberculate. Gena rounded, appearing continuous with anterior angle of head. Labrum produced as in *S. varasi*, tuberculate at center. Mandible in both sexes of general female lucanid form: apex acute with 1 internal tooth. Antennae (Fig. 7) almost completely glabrous but with scattered short setae, tomentosity confined to extreme apical portion of club segments; setae light yellow to white. **Pronotum:** Convex, nearly as long as wide. Disc anteriomedially with fovea bordered by one posterior and two lateral variably developed tubercles (Fig. 10); fovea punctate; punctures coarse, dense. Middle of disc behind tubercles depressed; depression continuing to basal margin, punctate; punctures in depression moderate to coarse, dense. Lateral margins almost parallel basally, weakly convergent anteriorly. Anterior angles produced, obtuse, punctate; punctures coarse, separated by one diameter. **Elytra:** Elongate, appearing parallel sided (Fig. 11). Disc irregularly punctate; punctures moderate, dense. Disc with four variably elevated longitudinal carinae; carinae shining, impunctate, varying from strong and continuous apically to barely discernible at base. **Wings:** Fully winged (Fig. 23) in both sexes. **Legs:** Metatibia at middle with small external tooth and 1–3 smaller proximal teeth. **Male Genitalia:** Parameres, median lobe, and internal sac as in Fig. 21; everted internal sac apparently simple, increasing in diameter distally.

**Diagnosis.** The trituberculate pronotum in combination with the elevated, shining interrupted carinae of the elytra will readily separate this species from its congeners. This species could only be confused with the similar *S. nitidus*, which shares the three weak

pronotal tubercles. However, the presence of the shining elytral carinae will immediately separate *S. tuberculatus*.

**Distribution** (Fig. 17). Chile, VII Región to X Región.

**Locality Data.** 60 specimens examined from CASC, FMNH, JMEC, MGAC, MLPA, MNHN, MNNC, ZIZM.

**CHILE** (60): VII Región (11): Bullileo, Cordillera Parral, El Coigo / El Coigual, Estero de Leiva, “Romehual”, R.N. Los Ruiles, R.N. Los Queules. VIII Región (2): Cordillera Chillan, Invernada, Las Trancas, Recinto. IX Región (30): “Cautín”, Cordillera Nahuelbuta W of Angol, Cunco, Curacautín, Llonquimay, 10 mi NE Pucon, 20 km E Temuco, Victoria. X Región (8): 18 km W Purranque, 30 km W Purranque, “Valdivia”.

**NO DATA** (8).

**Temporal Data.** January (32), February (5), October (2), November (3), December (2), NO DATA (16).

**Remarks.** Weinreich (1960) found no external differences between males and females of *S. tuberculatus* or *S. nitidus*, but two characters are usually dimorphic. In the majority of specimens that I examined, the apex of the hind tibia possessed three teeth that surround the blunt apex in males, whereas there were four teeth in females. However, one male (out of 33 specimens) did not fit this pattern. Teeth are, of course, subject to wear. Additionally, segments 2–7 of the antenna are proportionately shorter on females, but this character is difficult to use with confidence and without comparative material. The best method for determining the sex of specimens is genitalic extraction.

This species is not commonly collected. Specimens are found under the bark of fallen trees, but they are not encountered by this method as frequently as are *S. cucullatus* or *Pycnosiphorus* species. A method that has been successful recently is the use of insecticidal fogging machines, indicating that the habitat of this species is likely dead branches far above the ground. This could account for the apparent paucity of individuals in fallen trunks, where most sampling occurs.

### ***Sclerostomus varasi* Nagel, 1932** (Figs. 13, 17, 19)

*Sclerostomus varasi* Nagel, 1932: 115. Neotype male at MNNC labeled: a) “CHILE VII Region / RN. Altos de Lircay / 24-Feb-1999 / Col. Alejandro Vera”; b) “*Sclerostomus / varasi* / Nagel, 1932 / NEOTYPE / M.J. Paulsen 2005” on red paper; c) “*Sclerostomus varasi* / Nagel, 1932 / det. M.J. Paulsen 2005”. **NEOTYPE HERE DESIGNATED.** The name *Sclerostomus varasi* Nagel has been misapplied to *Pycnosiphorus philippi* following Weinreich (1960), and designation of a neotype is necessary to correct this taxonomic error (Art. 75, ICZN). In some collections, specimens of *S. varasi* were misidentified as *S. nitidus* Benesh. Also, a photograph of *S. varasi* was shown in Fig. 490-5 of Mizunuma & Nagai (1994) but misidentified as *S. cucullatus*. The original type specimen was undoubtedly destroyed during the 1943 bombing of the ZIZM (Weidner 1976), the

depository of Nagel's personal collection in that same year (Gaedike and Groll 2001). The holotype of *S. varasi* is not listed among the type holdings of the ZIZM (Weidner 1976, 1979). Of 17 specimens that I examined, only two are from near the original type locality, Termas de Chillan. These specimens are in poor condition (with missing legs and antennae). I chose a more complete specimen from a nearby locality to serve as the neotype.

**Description** (neotype male). **Length:** 16.0 mm; **Width:** 6.9 mm **Color:** Reddish-black to blue black. Iridescence in clean specimens. **Head:** Shape not enlarged, width subequal to width of one elytron. Vertex roundly excavated from anterior angles to base; excavation punctate; punctures dense, coarse. Margin of excavation strongly elevated above antennal insertions, punctate; punctures moderate, dense, decreasing in size and density with elevation. Gena as wide as and shorter than eye in dorsal aspect, lateral margins nearly parallel, not continuous with anterior angle of head. Anterior margin of frons not strongly declivous before labrum. Labrum prominent, protruding anteriorly, basal portion subtriangular, delimited by two transverse rows of setae converging at an apical tubercle, anteriolaterad of each setal row with rounded, setose lobe. Mandibles not longer than head, apices not strongly curved upward, tridentate including apex; teeth acute, subject to wear. Lacinia sclerotized, hook-like. Antennal club segments mostly glabrous but with scattered setae; terminal segment less than half tomentose; tomentosity confined to apex, golden. **Pronotum:** Shape broad, explanate, widest at basal third before narrowing to produced hind angle. Disc elevated anteriorly before declivous anterior face, anterior elevation punctate; punctures increasingly fine with elevation. Median depression large, longitudinally ovoid, acute anteriorly, bisecting anterior elevation, punctate; punctures becoming coarse medially and at base, largest punctures with scales. Vestiture consisting of wide band of scales laterally at margin; band at widest 4x wider than lateral bead, decreasing in width anteriorly, absent at anterior angle; scales yellow. Anterior angles rounded, subtriangular, projecting. Lateral margins broadly rounded anterolaterally, beaded. Basal bead complete, thickest at scutellum. **Scutellum:** Shape parabolic, as long as wide, basally punctate; punctures dense, moderate, lacking long setae. **Elytra:** Disc punctate; size and density of punctures variable, apparently dividing elytron into longitudinal thirds with differing punctation: Sutural third flat, iridescence prominent, punctate; punctures scarce and fine on disc, becoming moderately large and dense basally, coarse and nearly contiguous on apical declivity. Median third subrugose, rows of deep nearly contiguous punctures; punctures coarse, contiguous basally. Marginal third declivous, less punctate than median third; punctures large. Lateral margin subexplanate. Vestiture of sharply delineated band of scales similar in width to scale band of pronotum; scales yellow. **Wings:** Fully developed. **Legs:** Meso- and metatibiae each with only a single external tooth at about middle. Apex of metatibia acute. **Genitalia:** Parameres, median lobe, and internal sac as in Fig. 19; everted internal sac distally enlarged, medially with an area of dark setae.

**Description** males (n=10). **Length:** 16.0–16.3 mm. **Width:** 6.5–7.0 mm. Specimens differ from neotype male in amount of scales due to abrasion, degree of pronotal anterior elevation, and lack of iridescence in worn or teneral specimens. The tuberculate appearance of the anterior portion of the labrum is not always evident, perhaps due to wear.

**Description** females (n=6). **Length:** 14.6–17.1 mm. **Width:** 6.5–7.5 mm. Similar to males overall, but differ in the following characters. **Head:** Mandible apex acute, with 1 weak subapical tooth. **Pronotum:** Not elevated anteriorly, lacking declivous anterior face. **Legs:** Posterior tibiae truncate at apex when viewed dorsally.

**Diagnosis.** This species is easily distinguished by the lack of tubercles on the pronotum combined with the presence of non-uniform punctuation (varying from fine and sparse to coarse and rugose) on the elytra (puncture size uniformly moderate in *S. cucullatus*) and the presence of well-defined, wide lateral band of oval scales on the pronotum and elytra (unique in southern South American *Sclerostomus*).

**Distribution** (Fig. 17). Chile, VII Región and VIII Región.

**Locality Data.** 17 specimens examined from the CASC, CMNC, FMNH, MNNC, STAM, JTNC, SART.

**CHILE** (17): VII Región (13): R.N. Altos de Lircay, “Cordillera Parral”, Fundo Malcho, Vilches Alto. VIII Región (4): Invernada, Las Trancas, Shangri-la 75 km E Chillan.

Temporal Data. January (5), February (2), December (10).

**Remarks.** The life history and larvae of this species are unknown. Biological information accompanying one specimen indicates that it was collected while beating vegetation, but this would be unusual for stag beetles, and I find it improbable. In fact, the species is only rarely collected despite the activities of many collectors. Furthermore, the poor quality of most specimens on hand and accounts from collectors suggest that most specimens are encountered when already dead. For these reasons it is likely that *S. varasi* utilizes a habitat that is infrequently sampled, such as high, dead branches and the higher parts of standing dead trees. If this is true, insecticidal fogging might result in the collection of more specimens. Several of the oldest specimens I examined are from the locality “Fundo Malcho”, which is located east of Bullileo in VII Región. I traveled to this locality in late 2004, but pine plantations have apparently usurped most natural habitat in the area. No specimens of *S. varasi* were collected despite three days of concerted effort.

## Acknowledgments

I thank José Mondaca (Servicio Agrícola y Ganadero, Santiago, Chile) for his collecting expertise and invaluable assistance in the procurement of specimens and during our amazingly productive collecting trips. Thanks to the various private collectors listed above for generously loaning specimens, and to John Heraty, Dave Hawks, Matt

Buffington (University of California Riverside) for automontaged images. This project was supported by an NSF/PEET grant (DEB-0118669) to M. L. Jameson and B. C. Ratcliffe. Support for collection was provided by an NSF/BS&I grant (DEB-0342189) to A.B.T. Smith and F.C. Ocampo, and by a University of Nebraska Initiative for Ecology and Evolutionary Analysis grant to the author.

## References

- Arrow, G.J. (1936) The beetles belonging to the lamellicorn genus *Chiron*. *Annals and Magazine of Natural History*, 17 (10), 150–153.
- Arrow, G.J. (1943) On the genera and nomenclature of the lucanid Coleoptera, and descriptions of a few new species. *Proceedings of the Royal Entomological Society of London (B)*, 12, 133–143.
- Benesh, B. (1955) Some notes on neotropical stagbeetles. (Coleoptera: Lucanidae). *Entomological News*, 66 (4), 97–104.
- Benesh, B. (1960) *Coleopterorum Catalogus Supplementa, Pars 8: Lucanidea (sic)*. W. Junk, Berlin, 178 pp.
- Betz, O., Thayer, M.K. & Newton, A.F. (2003) Comparative morphology and evolutionary pathways of the mouthparts in spore-feeding Staphylinoidea (Coleoptera). *Acta Zoologica*, 84 (3), 179–238.
- Blanchard, C.É. (1842) *Insectes de l'Amérique Méridionale*. In: d'Orbigny, A., Blanchard, C.É., and Brullé, A. (Eds.), *Voyage dans l'Amérique Méridionale*, volume 6, part 2. P. Bertrand, Paris, plate 12.
- Blanchard, C.É. (1847) *Insectes de l'Amérique Méridionale*. In: d'Orbigny, A., Blanchard, C.É., & Brullé, A. (Eds.), *Voyage dans l'Amérique Méridionale*, volume 6, part 2. P. Bertrand, Paris. 448 pp.
- Bomans, H.E. (1990) Notes diverses sur des lucanides nouveaux ou peu connus (Coleoptera). *Nouvelle Revue Entomologie (N.S.)* 7, 171–177.
- Bomans, H. & Arnaud, P. (1996) Description d'une nouvelle espèce brésilienne du genre *Sclerostomus*. *Besoiro*, 2, 2–4.
- Bomans, H. & Arnaud, P. (2002) Description d'une nouvelle espèce de Lucanidae du Brésil. *Besoiro*, 8, 6–7.
- Burmeister, H. (1847) *Handbuch der Entomologie, Vol. 5*. T. C. F. Enslin, Berlin, 828 pp.
- Crisci, J. V., Cigliano, M. M., Morrone, J. J., & S. Roig-Juñent. (1991) Historical biogeography of southern South America. *Systematic Zoology*, 40 (2), 152–171.
- Didier, R., & Ségué, E. (1953) Catalogue illustré des lucanides du globe, Texte. *Encyclopedie Entomologique* (series A), 27, 12–23.
- Gaedike, R. & Groll, E. (2001) Entomologen der Welt (Biographien, Sammlungsverbleib). Datenbank, DEI Eberswalde im ZALF e.V. Available from: <http://www.zalf.de/deie/biograph.phtml> (accessed October 2004)
- Grossi, P.C. & Racca-Filho, F. (2004) A new Brazilian stag beetle of the genus *Sclerostomus* Burmeister, 1847 (Insecta: Coleoptera: Lucanidae). *Zootaxa*, 575, 1–4.
- Harold, E. (1868) *Catalogus coleopterorum, Lucanidae. Volume 3*. E. H. Gummi, Munich. pp. 941–978.
- Holloway, B.A. (1960) Taxonomy and phylogeny in the Lucanidae (Insecta: Coleoptera). *Records*

- of the Dominion Museum, 3(4), 321–365.
- Holloway, B.A. (1969) Further studies on generic relationships in Lucanidae (Insecta: Coleoptera) with special reference to the ocular canthus. *New Zealand Journal of Science*, 12, 958–977.
- Holloway, B.A. (1997) Elytral surface structures as indicators of relationships in stag beetles, with special reference to the New Zealand species (Coleoptera: Lucanidae). *New Zealand Journal of Zoology*, 24, 47–64.
- Huchet, J.B. (2000) Scisson du genre *Chiron* Macleay, 1819 et description de deux nouveaux genres de Chironidae (Coleoptera: Scarabaeoidea). *Annales de la Société Entomologique de France (N.S.)*, 36(1), 3–28.
- International Commission on Zoological Nomenclature. (1999) *International Code of Zoological Nomenclature, Fourth Edition*. ICZN, London, 306 pp.
- Luederwaldt, H. (1935) Monographia dos lucanideos brasileiros. *Revista do Museu Paulista*, 19, 447–574.
- Mizunuma, T., & S. Nagai. (1994) *The Lucanid Beetles of the World*. Mushi Sha, Tokyo, 337 pp.
- Morrone, J.J., Katinas, L., & Crisci, J.V. (1997) A cladistic biogeographic analysis of Central Chile. *Journal of Comparative Biology*, 2(1), 25–42.
- Nagel, P. (1932) Neues über Hirschkäfer. *Entomologische Blätter*, 28, 113–121.
- Parry, F.J.S. (1864) A catalogue of Lucanoid Coleoptera. *Transactions of the Entomological Society of London (3<sup>rd</sup> series)*, 2(1), 11–13.
- Parry, F.J.S. (1875) *Catalogus coleopterum lucanoidum*, 3<sup>rd</sup> edition. E.W. Janson, London, 29 pp.
- Samuelson, A., Evenhuis, N., & Nishida, G. (2001). The Insect and Spider Collections of the World Web Site. Bishop Museum, Honolulu, HI. Available from: <http://hbs.bishopmuseum.org/codens/codensearch.html> (accessed 26 May 2005)
- Sherborn, C. D. & Griffin, F.J. (1934) On the dates of publication of the natural history portions of Alcide d'Orbigny's 'Voyage Amérique Méridionale'. *Annals and Magazine of Natural History*, 73, 130–134.
- Smith, A.B.T. (2002) Revision of the southern South American endemic genus *Aulacopalpus* Guérin-Ménéville with phylogenetic and biogeographic analyses of the subtribe Brachysternina (Coleoptera: Scarabaeidae: Rutelinae: Anoplognathini). *Coleopterists Bulletin*, 56 (3), 379–437.
- Solier, A.J.J. (1851) Insectos, XVII. Lucanideos. In: Gay, C. (Ed.), *Historia física y política de Chile, Tomo Quinto, Zoología*. Gay, C., Paris, pp. 39–57.
- Thomson, J. (1862) Catalogue des Lucanides. *Annales de la Société Entomologique de France 4<sup>th</sup> series*, 2, 392–436.
- Van Roon, G. (1910) *Coleopterorum Catalogus, Pars 8 Lucanidae*. W. Junk, Berlin, 70 pp.
- Weidner, H. (1976) Die Entomologischen Sammlungen des Zoologischen Instituts und Zoologischen Museums der Universität Hamburg, IX. Teil, Insecta VI. *Mitteilungen aus dem Hamburgischen Zoologischen Museum und Institut*, 73, 87–264.
- Weidner, H. (1979) Die Entomologischen Sammlungen des Zoologischen Instituts und Zoologischen Museums der Universität Hamburg, Nachtrag zum IX. Teil, Insecta VI. *Mitteilungen aus dem Hamburgischen Zoologischen Museum und Institut*, 76, 395–468.
- Weinreich, E. (1960) Revision südamerikanischer Lucanidae (Ins. Col.), II. *Senckenbergiana Biologica*, 41 (1/2), 41–95.
- Westwood, J.O. (1845) *A catalogue of the Lucanoid coleoptera in the collection of the Rev. F. W. Hope, M.A., F.R.S., &c., President of the Entomological Society of London, together with descriptions of the new species therein contained*. J.C. Bridgewater, London, 31 pp.
- Wheeler, Q.D. & Platnick, N.I. (2000) The phylogenetic species concept (*sensu* Wheeler and Plat-

- nick). In: Wheeler, Q.D. & Meier, R., (Eds.), *Species concepts and phylogenetic theory, a debate*. Columbia University Press, New York City, 230 pp.
- Wilcox, K. (1996) *Chile's Native Forests*. Ancient Forest International, Redway, CA, 148 pp.